

# NASA TECH BRIEF

## Marshall Space Flight Center



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### Variable-Frequency Inverter Controls Torque, Speed, and Braking in AC Induction Motors

A new variable-frequency dc to ac inverter provides optimum frequency and voltage to an ac induction motor, in response to different motor-load and speed requirements. The inverter varies the slip frequency of the motor in proportion to the required torque. In addition, the inverter protects the motor from high current surges, controls the negative slip to apply braking, and returns the energy stored in the momentum of the load to the dc power source.

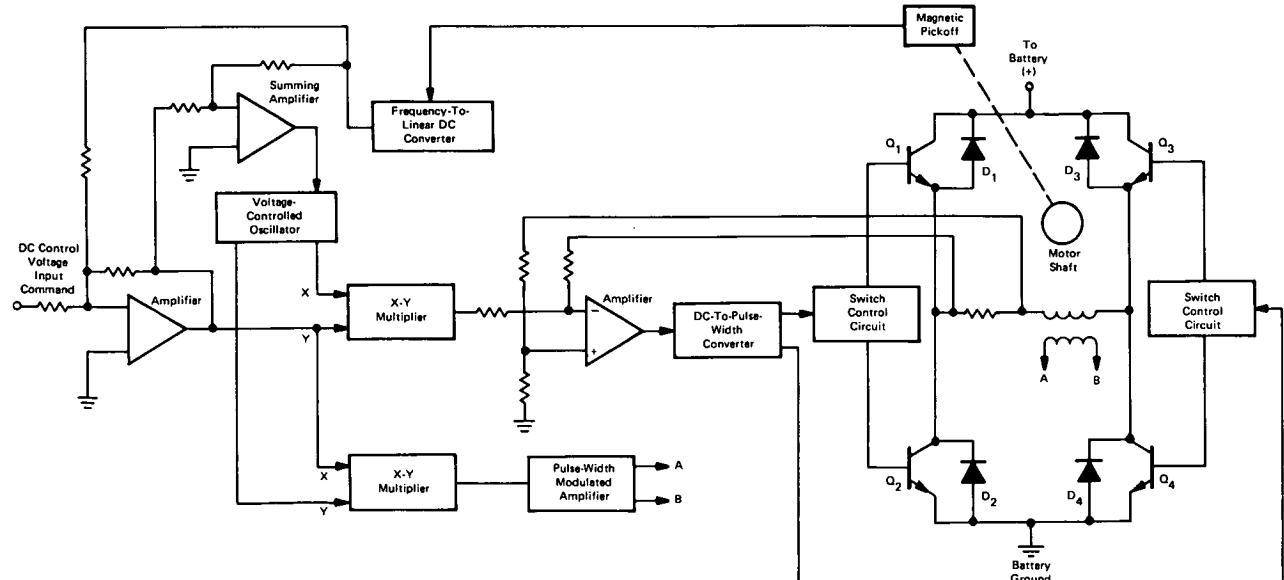
As shown in the inverter block diagram, speed is set by a speed input command (dc) voltage level. Feedback voltage, generated by the frequency-to-linear dc converter, is combined with the command voltage in the summing amplifier and is applied to the voltage-controlled oscillator. A magnetic pickoff is used as a frequency sensor in the speed feedback loop. The oscillator output is multiplied by the control voltage to produce a sinusoid with an amplitude proportional to the control

voltage. The sinusoid is converted to a pulse train, with variable pulse width, to feed the motor winding drivers.

The four drive transistors,  $Q_1$  through  $Q_4$ , operate in pairs to alternate current flow through the motor winding.  $Q_1$  and  $Q_4$  are one pair, and  $Q_2$  and  $Q_3$  are the other. Diodes  $D_1$  through  $D_4$  allow charge current flow back into the battery during braking. In this mode, the peak winding voltage (ac) exceeds the battery voltage, allowing the diodes to act as a bridge rectifier and conduct in pairs.

#### Note:

Requests for further information may be directed to:  
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 Reference: B73-10525



Variable-Frequency Inverter

(continued overleaf)

**Patent status:**

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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